Appendix II. Terrestrial Fate Residue Model and Examples

The model of Hoerger and Kenega (1972), as modified by Fletcher *et al.* (1994) was used to estimate pesticide concentrations on selected avian or mammalian food items. This model predicts the maximum concentrations that may occur immediately following a direct application at 1 lb ai/A. For 1 lb ai/A applications, concentrations on short grass, tall grass, broadleaf plants, and fruits are predicted to be as high as 240, 110, 135, and 15 ppm, respectively. The residue monitoring on which this model was based, did not include insects. However, based on similar surface area to volume ratio between insects and some plant parts, the predicted maximum concentration for broadleaf plants and fruits are used to represent maximum concentrations that may occur on small and large insects, respectively. Linear extrapolation is then used to estimate maximum terrestrial EEC's for single applications at other application rates.

The peak terrestrial EECs resulting from multiple applications were estimated by summing the maximum EEC predicted for the last application with to the remaining portions of the maximum concentrations predicted for all previous applications. After application, residues on food items are predicted to decline according to a first order exponential model. If the maximum initial concentration is C_0 and the half-life for the exponential dissipation of the active ingredient is $t_{1/2}$, the remaining concentration at time t is given by the following formula:

$$C_t = C_0 e^{-\frac{t \ln 2}{t_{1/2}}}$$

The general formula for the peak EEC (C_{peak}) following multiple applications is:

$$C_{peak} = \sum_{i-1}^{n} C_0 e^{-\frac{I(n-1)\ln 2}{t_{1/2}}}$$

where C_0 is the maximum initial concentration after one application, I is the interval in days between applications, n is the number of applications, and $t_{1/2}$ is the half-life of the active ingredient.

The initial concentration, half-life, number of applications, interval between treatments, and length of simulation are variable. The current Fate Model has two limitations: 1) for more than two applications, only one time interval can be designated for a run; and 2) between treatments per fate run (i.e., two or more treatment intervals can not be used per run).
Four examples of Fate Model printouts follow; one each for short grass, foliage and small insects, long grass, and fruits, seeds and large insects.

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON SHORT GRASS AT 1.0 LB AI./A

Chemical name   --   CHLORPYRIFOS
Initial concentration (ppm) ----------------------------   240
Half-life ---   7
A number of application -----------------------------   3
Application interval   -----------------------------------   7
Length of simulated   (day) ---------------------------   36

DAY	RESIDUE (PPM)
0	240
1	217.3737
2	196.8805
3	178.3193
4	161.508
5	146.2816
6	132.4907
7	360
8	326.0605
9	295.3207
10	267.479
11	242.262
12	219.4225
13	198.7361
14	420
15	380.4039
16	344.5408
17	312.0588
18	282.6391
19	255.9929
20	231.8588
21	210
22	190.202
23	172.2704
24	156.0294
25	141.3195
26	127.9964
27	115.9294
28	105
29	95.10098
30	86.13519
31	78.01469
32	70.65975
33	63.99821
34	57.96469
35	52.5
36	47.55049

Maximum residue ----------------------   420
Average residue   ----------------------   194.0622

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON FOLIAGE AT 1.0 LB AI/A

Chemical name   --------------------------------------   CHLORPYRIFOS
Initial concentration (ppm) --------------------------   135
Half-life ---   7
A number of application -----------------------------   3
Application interval   ---------------------------------   7
Length of simulated   (day) --------------------------   36

DAY	RESIDUE (PPM)
0	135
1	122.2727
2	110.7453
3	100.3046
4	90.84825
5	82.28342
6	74.52604
7	202.5
8	183.409
9	166.1179
10	150.4569
11	136.2724
12	123.4251
13	111.7891
14	236.25
15	213.9772
16	193.8042
17	175.5331
18	158.9844
19	143.996
20	130.4206
21	118.125
22	106.9886
23	96.9021
24	87.76652
25	79.49222
26	71.99799
27	65.21028
28	59.0625
29	53.4943
30	48.45105
31	43.88327
32	39.74611
33	35.99899
34	32.60513
35	29.53125
36	26.74715

Maximum residue   ----------------------   236.25
Average residue   ----------------------   109.16

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON LONG GRASS AT 1.0 LB AI/A

Chemical name -------------------------------------- CHLORPYRIFOS
Initial concentration (ppm) -------------------------- 110
Half-life -- 7
A number of application ----------------------------- 3
Application interval --------------------------------- 7
Length of simulated (day) -------------------------- 36

DAY	RESIDUE (PPM)
0	110
1	99.6296
2	90.23689
3	81.72969
4	74.02451
5	67.04575
6	60.72492
7	165
8	149.4444
9	135.3553
10	122.5945
11	111.0368
12	100.5686
13	91.08739
14	192.5
15	174.3518
16	157.9146
17	143.027
18	129.5429
19	117.3301
20	106.2686
21	96.2539
22	87.17589
23	78.95726
24	71.51346
25	64.77144
26	58.66503
27	53.1343
28	48.125
29	43.58795
30	39.47863
31	35.75673
32	32.38572
33	29.33251
34	26.56715
35	24.0625
36	21.79397

Maximum residue ---------------------   192.5
Average residue ---------------------   88.94514

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON FRUIT & SEEDS AT 1 LB AI/A

Chemical name --------------------------------------- CHLORPYRIFOS
Initial concentration (ppm) --------------------------- 15
Half-life --- 7
A number of application ------------------------------ 3
Application interval ----------------------------------- 7
Length of simulated (day) -------------------------- 36

DAY	RESIDUE (PPM)
0	15
1	13.58586
2	12.30503
3	11.14496
4	10.09425
5	9.142602
6	8.280671
7	22.5
8	20.37878
9	18.45745
10	16.71744
11	15.14138
12	13.7139
13	12.42101
14	26.25
15	23.77525
16	21.5338
17	19.50367
18	17.66494
19	15.99955
20	14.49117
21	13.125
22	11.88762
23	10.7669
24	9.75183
25	8.83247
26	7.999777
27	7.245587
28	6.5625
29	5.943812
30	5.38345
31	4.875918
32	4.416235
33	3.999888
34	3.622793
35	3.28125
36	2.971905

Maximum residue ---------------------- 26.25
Average residue ---------------------- 12.12888

DAILY ACCUMULATED PESTICIDE RESIDUES — MULTIP. APPL. ON SHORT GRASS AT 2 LBS AI/A

Chemical name --------------------------------------	CHLORPYRIFOS
Initial concentration (ppm) ---------------------------	480
Half-life --	7
A number of application ------------------------------	3
Application interval -----------------------------------	7
Length of simulated (day) ---------------------------	35

DAY	RESIDUE (PPM)
0	480
1	434.7474
2	393.761
3	356.6387
4	323.016
5	292.5633
6	264.9815
7	720
8	652.121
9	590.6415
10	534.958
11	484.5241
12	438.8449
13	397.4722
14	840
15	760.8079
16	689.0817
17	624.1176
18	565.2781
19	511.9857
20	463.7176
21	420.4039
22	380.4039
23	344.5408
24	312.0588
25	282.6391
26	255.9929
27	231.8588
28	210
29	190.202
30	172.2704
31	156.0294
32	141.3195
33	127.9964
34	115.9294
35	105
Maximum residue ----------------------	840
Average residue ----------------------	396.2638